

BIOCHEMISTRY, B.S.

Program Description

The biochemistry major provides students with a strong foundation in the science of biochemistry, including coursework in chemistry and biology.

Students will not only gain theoretical and applied problem-solving in the classroom but will get practical hands-on laboratory experience in biochemistry, chemistry, and biology. The major is interdisciplinary and focuses on the structure and function of biomolecules (e.g. proteins, DNA, RNA, etc.) that drive biological processes.

Why Take This Major?

Biochemistry is an interdisciplinary field that sits at the boundary between biology and chemistry. From understanding the molecular mechanisms underlying immunity, cell signaling, gene expression, metabolism, and cancer to exploring the structure and function of biomolecules such as DNA and proteins, biochemistry offers an exciting path for those passionate about making a real-world impact in medicine, health, or scientific research. With a biochemistry degree, you'll be well-equipped for a wide range of jobs in science, medicine, academia, or the industries of pharmaceuticals, biotech, agriculture, cosmetics, and environment.

Our graduates have attended some of the best graduate schools in the country and area including University of Pennsylvania, Johns Hopkins University, University Michigan, Ohio State University, Temple University, and Drexel University. Many of our students have become physicians, lawyers, or teachers, while other graduates have obtained lucrative employment in the chemical, biochemical, and pharmaceutical industry.

No matter what their chosen career path, our graduates excel because our department trains them in the critical thinking and problem solving. As a liberal arts university, La Salle has a curriculum that offers a solid background in the fundamentals of chemical and biochemical sciences coupled with a broad-based education. Students are made aware of the interconnections of biochemistry with the other sciences and also with the social sciences, business, and the humanities. With such an education, our graduates leave La Salle as dynamic, adaptable, and prepared individuals ready for almost anything they will face in the future.

Degree Earned

Bachelor of Science (B.S.)

Required for Graduation

- Courses
 - Major: 19 Courses: 9-11 Chemistry, 3-5 Biology, 2 Math, 2 Physics, 1 Computer Science
- Credits
 - Major: 73
 - Total: 130 to 132 depending on options chosen
- GPA
 - Major: 2.0
 - Cumulative: 2.0

Student Learning Outcomes

- Students will execute biochemical experimental laboratory techniques.

- Students will communicate scientific ideas and research both orally and in writing to both general and scientific audiences.
- Students will persist, think critically, and problem solve in tackling complex scientific problems.
- Students will explain the importance of biochemistry in addressing societal issues.
- Students will explain, visualize, and interpret biochemistry at a macroscopic or (molecular) microscopic level.

Progress Chart

Level One - Core Courses

12 courses and 2 modules required.

Major Requirements

Major requirements include 4 Level Two ILO requirements, fulfilled through the major.

Students must complete **19 Courses (9-11 Chemistry, 3-5 Biology, 2 Math, 2 Physics, 1 Computer Science)** for this major.

Code	Title	Credits
Level One - Core Courses		
<i>Universal Required Courses</i>		
Students must complete the following 4 courses.		
ILO 8.1: Written Communication (https://catalog.lasalle.edu/undergraduate/ilo/)		
ENG 110	College Writing I: Persuasion	3
ILO 5.1: Information Literacy (https://catalog.lasalle.edu/undergraduate/ilo/)		
ENG 210	College Writing II: Research	3
ILO 1.1: Understanding Diverse Perspectives (https://catalog.lasalle.edu/undergraduate/ilo/)		
FYS 130	First-Year Academic Seminar ¹	3
ILO 2.1: Reflective Thinking and Valuing (https://catalog.lasalle.edu/undergraduate/ilo/)		
REL 100	Religion Matters	3
<i>Elective Core Courses</i>		
Students must complete 1 course in each of the following 4 ILOs.		
ILO 3.1a: Scientific Reasoning (https://catalog.lasalle.edu/undergraduate/ilo/)		
CHM 111	General Chemistry I	4
ILO 3.1b: Quantitative Reasoning (https://catalog.lasalle.edu/undergraduate/ilo/)		
MTH 120	Calculus I	4
ILO 6.1: Technological Competency (https://catalog.lasalle.edu/undergraduate/ilo/)		
CSC 152	Computer Technology for the Sciences	3
ILO 8.1a/12.1: Oral Communication/Collaborative Engagement (https://catalog.lasalle.edu/undergraduate/ilo/)		
Choose course within ILO (https://catalog.lasalle.edu/undergraduate/ilo/)		3
<i>Distinct Discipline Core Courses</i>		
Students must complete 1 course in each of the following 4 ILOs. Each course must be from a different discipline. (A "discipline" is represented by the 3- or 4-letter prefix attached to each course.)		

ILO 4.1: Critical Analysis and Reasoning (https://catalog.lasalle.edu/undergraduate/ilo/)	
Choose course within ILO (https://catalog.lasalle.edu/undergraduate/ilo/)	4
ILO 9.1: Creative and Artistic Expression (https://catalog.lasalle.edu/undergraduate/ilo/)	
Choose course within ILO (https://catalog.lasalle.edu/undergraduate/ilo/)	3
ILO 10.1: Ethical Understanding and Reasoning (https://catalog.lasalle.edu/undergraduate/ilo/)	
Choose course within ILO (https://catalog.lasalle.edu/undergraduate/ilo/)	3
ILO 11.1: Cultural and Global Awareness and Sensitivity (https://catalog.lasalle.edu/undergraduate/ilo/)	
Choose course within ILO (https://catalog.lasalle.edu/undergraduate/ilo/)	3
<i>Universal Required Modules</i>	
Students must complete the following 2 non-credit modules. ²	
ILO 7.1a (https://catalog.lasalle.edu/undergraduate/ilo/)	
Health Literacy Module	
ILO 7.1b (https://catalog.lasalle.edu/undergraduate/ilo/)	
Financial Literacy Module	
Major Requirements	
<i>Level Two</i>	
Students must complete 1 course/learning experience in each of the 4 commitments.	
ILO 2.2: Broader Identity (Capstone Course/Experience) (https://catalog.lasalle.edu/undergraduate/ilo/)	
CHM 480 Chemical Research (ILO 2.2)	3-4
or CHM 499 Chemistry Capstone	
Select one ILO from 3.2a, 3.2b, 4.2, 5.2, 6.2, 7.2a, or 7.2b: Expanded Literacies (https://catalog.lasalle.edu/undergraduate/ilo/)	
CHM 202 Organic Chemistry II (ILO 3.2a)	4
or CHM 331 Thermodynamics and Kinetics	
ILO 8.2b: Effective Expression (Writing-Intensive Course) (https://catalog.lasalle.edu/undergraduate/ilo/)	
CHM 412 Biochemistry II (ILO 8.2b)	4
Select one ILO from 10.2, 11.2, or 12.2: Active Responsibility (https://catalog.lasalle.edu/undergraduate/ilo/)	
CHM 212 Quantitative Analysis (ILO 12.2)	4
<i>All Other Required Courses</i>	
BIO 210 Integrated Biology I- Molecules and Cells	4
BIO 402 Cell Biology	4
BIO 413 Molecular Biology	4
CHM 111 General Chemistry I	4
CHM 112 General Chemistry II	4
CHM 201 Organic Chemistry I	4
CHM 202 Organic Chemistry II	4
CHM 212 Quantitative Analysis	4
CHM 331 Thermodynamics and Kinetics	4
CHM 411 Biochemistry I	4
CHM 412 Biochemistry II	4
CHM 499 Chemistry Capstone	1
CSC 152 Computer Technology for the Sciences	3

MTH 120 Calculus I	4
MTH 221 Calculus & Anal Geom II	4
PHY 105 General Physics I	4
PHY 106 General Physics II	4
Select two Elective courses from the list below. ³	6-8
BIO 306 Neurobiology	
BIO 310 Genetics	
BIO 430 The Biology of Cancer	
CHM 311 Instrumental Analysis	
CHM 320 Organic Laboratory Methods	
CHM 332 Quantum Mechanics and Spectroscopy	
CHM 403 Advanced Inorganic Chemistry	

Free Electives

In addition to the requirements listed above, students must take enough courses to the fulfill graduation credit requirements for their School and major.

Total Credits **124-127**

1

NOTE. The following students use Level 2 Capstone Experience in Major instead of FYS 130 First-Year Academic Seminar: Honors, BUSCA, Core-to-Core, Transfer, and Non-Traditional/Evening.

2

The Modules are **not** required for Transfer Students, Core-to-Core Students, or BUSCA Students. BUSCA students are required to take modules if/when they pursue a bachelor's degree.

3

For students double majoring in Biology and Biochemistry, the two electives must be Chemistry courses.

For students double majoring in Chemistry and Biochemistry, the two electives must be Biology courses.

Recommended Course Sequence

Course	Title	Credits
First Year		
First Semester		
CHM 111	General Chemistry I	4
MTH 120	Calculus I	4
Credits		8
Second Semester		
CHM 112	General Chemistry II	4
MTH 221	Calculus & Anal Geom II	4
CSC 152	Computer Technology for the Sciences	3
Credits		11
Second Year		
First Semester		
CHM 201	Organic Chemistry I	4
PHY 105	General Physics I	4
Credits		8
Second Semester		
CHM 202	Organic Chemistry II	4
PHY 106	General Physics II	4
BIO 210	Integrated Biology I- Molecules and Cells	4
Credits		12
Third Year		
First Semester		
BIO 402	Cell Biology	4

Elective		4
	Credits	8
Second Semester		
CHM 212	Quantitative Analysis	4
CHM 331	Thermodynamics and Kinetics	4
BIO 413	Molecular Biology	4
	Credits	12
Fourth Year		
First Semester		
CHM 411	Biochemistry I	4
Elective		4
	Credits	8
Second Semester		
CHM 412	Biochemistry II	4
CHM 499	Chemistry Capstone	1
	Credits	5
	Total Credits	72

* Note that CHM 412 and CHM 331 are rotated every other year. CHM 331, CHM 411, CHM 412 may be taken in the junior year or senior year depending on course rotation schedule.

Dual Major Requirements

Biology majors wishing to double major with Biochemistry need to take two Chemistry courses as their electives.

Chemistry majors wishing to double major with Biochemistry need to take two Biology courses as their electives.

Course Descriptions

Biology

BIO 210 Integrated Biology I- Molecules and Cells

This course provides an introduction to five core concepts in biology (Information, Evolution, Cells, Homeostasis, and Emergent Properties) through an active learning, inquiry-based examination of molecules and cells. Critical thinking and quantitative reasoning are applied to authentic data to construct foundational knowledge. By engaging in the process of science, students will gain proficiency in core scientific competencies. 6 hour CURE course. Restriction(s): Students must be eligible for Math 113 or Math 120 and Chem 111 Prerequisite(s): High school or college chemistry.

BIO 310 Genetics

This course is an introduction to genetics at the molecular, cytological, and organismal level. Included are the thorough coverage of Mendelian and other basic transmission genetics phenomena in the light of our knowledge of DNA and cell structure and function; mutation and mutagenesis; and an introduction to recombinant DNA. Three hours lecture; three hours laboratory Prerequisite(s): A final grade of C- or higher in BIO 230 is required in order to advance to 300/400-level BIO courses.

BIO 402 Cell Biology

This course examines the physical properties, chemical structure, and metabolism of simple and specialized cells, as well as recent advances in the techniques of cell culture and investigation. Two hours lecture; two hours laboratory. Prerequisite(s): A final grade of C- or higher in BIO 230 is required in order to advance to 300/400-level BIO courses.

BIO 413 Molecular Biology

This is a survey course that will examine the basic concepts of molecular biology. Topics include mechanisms and regulation of DNA replication, transcription, and translation, recombinant DNA technology, molecular aspects of gene interaction and recombination, cellular transformation, and the molecular biology of the nervous and immune systems. The laboratory focuses on utilizing the basic techniques currently employed in molecular biology (molecular cloning, ELISA, genetic recombination, gel electrophoresis, etc.) Three hours lecture; three hours laboratory. Prerequisite(s): BIO 412

BIO 430 The Biology of Cancer

The cellular and molecular mechanisms driving cancer's hallmark phenotypes will be explored. These include proliferative signaling, evading growth suppressors, resisting cell death, enabling replicative immortality, inducing angiogenesis, activating invasion and metastasis, reprogramming of energy metabolism and evading immune destruction. Within these conceptual frameworks, primary scientific literature will be examined and clinical implications of the research evaluated. Students will choose a specific area of interest, allowing them to develop an in-depth understanding of the current "state-of-the-art" in a field of research. Students will gain an informed understanding of the inherent challenges cancer presents and assess the prospects of treating and ultimately curing the disease. Prerequisite(s): A final grade of C- or higher in BIO 230 is required in order to advance to 300/400-level BIO courses.

BIO 472 Neurobiology

This course involves a lecture-laboratory study of the nervous system, including principles of membrane biophysics, cellular neurophysiology, systems neurophysiology, and neuroanatomy. Three hours lecture; three hours laboratory. Prerequisite(s): A final grade of C- or higher in BIO 230 is required in order to advance to 300/400-level BIO courses.

Chemistry

CHM 111 General Chemistry I

General Chemistry I provides a firm basis for understanding the fundamentals of chemistry. This course covers atomic and molecular structure, stoichiometry, thermochemistry, and the periodic table. The descriptive chemistry is principally concerned with the reactions of nonmetals and of ions in solution. The course consists of three hours of lecture and three hours of laboratory. Prerequisite(s): MTH 101 (C+ or better) or equivalent

CHM 112 General Chemistry II

General Chemistry II builds on the concepts of General Chemistry I and focuses on gasses, properties of solutions, kinetics, equilibrium, acid-base chemistry, and electrochemistry. The laboratory experiments reinforce the concepts covered in lecture. The course consists of three hours of lecture and three hours of laboratory. Prerequisite(s): CHM 111 (C- or better)

CHM 201 Organic Chemistry I

Organic Chemistry is the study of compounds containing carbon. This course is focused on the structure, bonding, and stereochemistry of these compounds together with an introduction to reactions, reaction mechanisms, and synthesis. This course, as well as CHM 202, is intended for students majoring in chemistry, biochemistry, and biology as well as those pursuing a career in the health professions. The laboratory introduces techniques used in organic synthesis, separation, purification, and structure elucidation. The course consists of three hours of lecture and three hours of laboratory. Prerequisite(s): CHM 112 (C- or better)

CHM 202 Organic Chemistry II

The second semester of Organic Chemistry builds on the foundation established in CHM 201. The functional group and mechanistic approach to organic reactions allows for a more in-depth approach to organic synthesis. The use of basic spectral methods as a means of structure elucidation is also covered in this course. The course consists of three hours of lecture and three hours of laboratory. Prerequisite(s): CHM 201 (C- or better)

CHM 212 Quantitative Analysis

This course covers important areas of analytical chemistry, including statistics, error analysis, chemical equilibria, electrochemistry, and colorimetry. This course consists of three hours of lecture and three hours of laboratory. Prerequisite(s): CHM 112 (C- or better)

CHM 311 Instrumental Analysis

CHM 311 covers the theory and practice of physical measurements with modern chemical instrumentation. The course is divided into two parts: spectroscopic and separation methods. Topics include UV-visible, FT-IR, fluorescence, and magnetic resonance spectroscopies as well as mass spectrometry, gas and liquid chromatographies. The course consists of three hours of lecture and three hours of laboratory. Prerequisite(s): CHM 112 (C- or better) or permission from instructor

CHM 320 Organic Laboratory Methods

This is a course in modern methods of organic synthesis and structure elucidation. This laboratory-intensive course emphasizes asymmetric synthesis, green chemistry, advanced spectral methods, and literature searching. The course consists of 75 minutes of lecture and six hours of laboratory. Prerequisite(s): CHM 202 (C- or better)

CHM 331 Thermodynamics and Kinetics

This course applies the principles of thermodynamics and kinetics to explain the behavior of gases, liquids, solids, and solutions. Topics include the elucidation of chemical equilibria, phase transitions, reaction mechanisms, and statistical ensembles of energy states. The course consists of three hours of lecture and three hours of laboratory. Prerequisite(s): CHM 202, MTH 121, PHY 106 (C- or better in all)

CHM 332 Quantum Mechanics and Spectroscopy

This course uses the formalism of quantum mechanics to understand fundamental chemical systems. It explores atomic and molecular structures, molecular vibrations, and molecular rotations. It also explores the use of spectroscopy to probe these chemical processes. The course consists of three hours of lecture and three hours of laboratory. Prerequisite(s): CHM 112, MTH 221, PHY 106 (C- or better in all)

CHM 403 Advanced Inorganic Chemistry

This course covers theoretical and practical aspects of chemical bonding, descriptive periodic trends, and molecular structure and symmetry of molecules. A special emphasis is given to the chemistry of the transition metals, including coordination and organometallic chemistry. This course consists of three hours of lecture and three hours of laboratory. Prerequisite(s): CHM 202

CHM 411 Biochemistry I

Biochemistry I examines the biochemistry of proteins, carbohydrates, fats, vitamins, enzymes, and hormones from a chemist's perspective and emphasizes their role in metabolic processes. Laboratory work illustrates common techniques used to isolate, identify, and assay these molecules, such as chromatography, electrophoresis, and kinetic analysis. The course consists of three hours of lecture and three hours of laboratory. Prerequisite(s): CHM 202

CHM 412 Biochemistry II

Biochemistry II focuses on the storage, replication, transmission, and expression of genetic information. It also examines recombinant DNA methodology and physiological processes at the molecular level. Laboratory work includes the isolation and analysis of plasmid DNA, creation of a new plasmid, and transformation into bacterial cells. The course consists of three hours of lecture and three hours of laboratory. Prerequisite(s): CHM 411

CHM 499 Chemistry Capstone

This is the capstone course for senior-level chemistry and biochemistry majors. It is intended to broadly expose students to select topics that span sub-disciplines in chemistry and current trends in chemical science. The course is discussion-based and student-driven, and students will be required to examine their scientific ideas through research, reflection, and communication of topics in the chemical sciences.

Computer Science**CSC 152 Computer Technology for the Sciences**

This course provides a survey of computers and computer systems as well as problem-solving and computer applications for science and mathematics, including data analysis and regression. It includes an introduction to a PC-based Graphical User Interface/ windowed operating system and covers word processing, design and use of electronic spreadsheets, and presentation software. Internet use includes electronic mail and the World Wide Web. Restriction(s): Credit will be given for only one of CSC 151, 152, 154, and 155. Prerequisites: Mth 101 or 102M Math Placement Score

Math**MTH 120 Calculus I**

Topics in this course include functions of various types: rational, trigonometric, exponential, logarithmic; limits and continuity; the derivative of a function and its interpretation; applications of derivatives, including finding maxima and minima and curve sketching; antiderivatives, the definite integral and approximations; the fundamental theorem of calculus; and integration using substitution. A TI graphing calculator is required. Prerequisite(s): MTH 119 or its equivalent

MTH 121 Calculus II

This course addresses differentiation and integration of inverse trigonometric and hyperbolic functions; applications of integration, including area, volume, and arc length; techniques of integration, including integration by parts, partial fraction decomposition, and trigonometric substitution; L'Hopital's Rule; improper integrals; infinite series and convergence tests; Taylor series; parametric equations; polar coordinates; and conic sections. A TI graphing calculator is required. Prerequisite(s): MTH 120

Physics**PHY 105 General Physics I**

Vectors, elementary mechanics of point particles and rigid bodies, and gravitation will be the topics that are explored in this course. The course is comprised of four hours of lecture and two hours of lab each week. Prerequisite(s): none Corequisite(s): PYL 105 and MTH 120

PHY 106 General Physics II

Simple harmonic motion and waves, elementary optics, electromagnetism, and DC circuits are topics of emphasis in this course. The course is comprised of four hours of lecture and two hours of lab each week. Prerequisite(s): PHY 105 Corequisite(s): PYL 106

Program Contact Information

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